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SPECIFICATION NO. 56-1046-A-T

AS-3 Development Test Specifications

26 April 1956

1. GENERAL

This test specification shall be a part of Specification No. 56-A-1046-A, covering the development of the AS-3 communications equipment.

1.1. Purpose of This Specification

This specification shall outline the test procedure to be conducted on completed prototypes. Necessary test equipment is itemized, test methods are described, and the test requirements are presented.

1.2. Submittal of Test Data

Test data shall be submitted simultaneously with the delivery of prototype models.

1.3. Test Equipment

The following test equipment is necessary to conduct prototype tests.

1.3.1. Secondary Frequency Standard

Military BC-221, or equivalent.

1.3.2. Tachometer, Electronic

General Radio, Strobotac Type 631-B, or equivalent.

1.3.3. Sound Level Meter

General Radio, Type 759-B, or equivalent.

1.3.4. Wide Band Oscilloscope

Tektronix Type 511-AD, or equivalent.

1.3.5. RF Milliampere Meter

Any type calibrated to within 2% accuracy at full scale.

1.3.6. Non-Inductive R.F. Dummy Loads

Any type having values of 75, 150, 300, 600, and 1200 ohms.

1.3.7. Field Intensity Meter

Stoddart Model NM-20-A, or equivalent.

1.3.8. Communications Receiver

Any type(s) capable of receiving AM and CW signals in the range of from 3 to 220 megacycles.

1.3.9. Crystal Correlation Meter

This item will be Government-furnished on a loan basis.

2. TEST DATA

When operating with AC mains power, the line voltage will be matched to within ± 2% of the rated input tap of the power supply in service.

When operating with battery power, specifications are based on the use of fully charged batteries.

3. TESTS

3.1. Frequency Test Points

AS-3 tests, unless otherwise specified, shall be made at the low end, center, and the high end of each band.

3.2. Temperature Extremes

3.2.1. Operating Temperature

3.2.1.1. Low Extreme with AP/BA-3 Power Supply

Method of Test

a. The complete equipment, utilizing the AP/BA-3 power supply less the battery, shall remain unenergized in a temperature chamber for a period of 12 hours at -5 degrees C. The temperature shall then be reduced to -40 degrees C,and the equipment shall remain unenergized in the chamber for a period of four (4) hours.

b. An external battery source, whose temperature is at normal room levels, shall be connected to the AP/BA-3 power unit.

c. The transmitter shall be adjusted for operation at the high frequency end of each band, and connected to a 300 ohm dummy antenna.

d. The system shall be energized and allowed to warm for a period not to exceed five (5) minutes with no keying.

e. The general conditions of Section 3.3.1. and either 3.4.1. or 3.4.2. as applicable will apply.

Requirement:

The system shall operate without malfunction of any of the components.

3.2.1.2. Low Extreme with AP/AC-3

Repeat the test of Section 3.2.1.1., using the AP/AC-3 power supply.

3.2.1.3. High Extreme with AP/BA-3

Method of Test

a. The entire equipment, utilizing the AP/BA-3 power supply with battery, shall be soaked for a period of 24 hours at 50 degrees C.

b. The test conditions of Section 3.2.1.1. (c), (d), and (e) shall apply, except that the unit must remain energized for 30 minutes.

Requirement:

The system shall operate without malfunction of any of the components.

3.2.1.4. High Extreme with AP/AC-3

Repeat the test of Section 3.2.1.3., using the AP/AC-3 power supply.

3.2.2. Storage Temperature

3.2.2.1. Low Extreme

Method of Test

a. The entire equipment, less batteries, shall be soaked for a period of four (4) hours at -60 degrees C.

b. The equipment shall be returned to normal room temperature of not less than 20 degrees C, nor more than 25 degrees C, and allowed to normalize for a period of four (4) hours.

c. The test conditions of Section 3.2.1.1. (c), (d), and (e) shall apply.

Requirement:

The system shall operate without malfunction of any of the components.

3.2.2.2. High Extreme

Method of Test

a. The entire equipment shall be soaked for a period of 24 hours at plus 60 degrees C.

b. All conditions of Section 3.2.2.1. (b) and (c) shall apply.

Requirement:

The system shall operate without malfunction of any of the components.

3.3. AT-3 Transmitter

3.3.1. Power Output

Method of Test

a. The transmitter shall be set to the frequencies of Section 3.1.

b. The transmitter shall be loaded into the appropriate load resistors in series with an R.F. milliammeter or in parallel with an R.F. voltmeter.

c. Power calculation shall be I^2R or $\frac{E2}{R}$.

d. Tests shall be conducted using the following dummy antenna impedances, and included in the calculation shall be the known resistance of the meter: 75, 150, 300, 600, and 1200 ohm non-inductive dummy load antennas.

Requirement:

The transmitter shall deliver not less than 25 watts over the entire design spectrum.

3.3.2. Keying Characteristics

3.3.2.1. Hand Keying at Manual Rates

Method of Test

a. The transmitter shall be loaded into a 300 ohm dummy load and keyed at a rate of 12 dot cycles per second. The transmitter shall be set for simple OFF-ON keying.

b. The keyed waveshape shall be observed directly on a wide band oscilloscope.

c. In addition, the resultant signal shall be inspected for "chirping," key clicks and other irregular wave shapes by tuning a communications receiver to the carrier frequency.

Requirement:

The envelope of the keyed wave shall possess rounded corners on the leading and trailing edges and shall have no sharp peaks or abrupt transients. The observed signal shall be free from key clicks and "chirping) over the entire frequency range of the equipment.

3.3.2.2. Keying at Automatic Sending Speeds

Method of Test

a. The transmitter shall be loaded into a 300 ohm dummy antenna and keyed at a rate of 150 dot cycles per second. The transmitter function switch shall be set in the position "MSG."

b. The conditions of Section 3.3.2.1. (b) and (c) shall apply.

Requirement:

The conditions of Section 3.3.2.1. shall apply.

3.3.3. Crystal Input Capacity

Method of Test

a. The transmitter shall be tuned into a 300 ohm load at 6 megacycles.

b. The transmitter frequency shall be measured using a secondary frequency standard.

c. The crystal is removed from the transmitter and inserted in the crystal oscillator correlation circuit of Section 1.3.9.

d. The input capacity shall be varied to produce the same frequency as determined in step "b."

Requirement:

The input capacity shall not be less than 26 mmf nor more than 32 mmf.

3.3.4. Crystal Current

Method of Test

a. Crystal current shall be measured by inserting an R.F. milliammeter (0-50 ma) in series connection with the crystal. Leads are to be as short as possible.

Requirement:

The crystal current shall not exceed 30 milliamperes R.F. under any condition of tuning or operation over the entire range of the equipment.

3.3.5. Interference

3.3.5.1. Key Click Radiation

Method of Test

a. The transmitter shall be set up for operation at 6 megacycles, loaded into a 300 ohm dummy load, switches set for manual OFF-ON keying, and keyed at 12 dot cycles per second.

b. The Stoddart Field Intensity meter shall be operated at a distance of one foot from the AT-3 and tuned throughout its frequency range of from 150 kilocycles to 25 megacycles. The spectrum shall be visibly and audibly monitored for the presency of key-click radiation.

Requirement:

No key-click radiation shall be permissible.

3.3.5.2. Harmonic Radiation

Method of Test

a. The transmitter shall be set up for operation at the frequency test points defined by Section 3.1. and loaded into a 300 ohm dummy antenna.

b. The transmitter shall be keyed in a "key down" condition, radiating a steady carrier devoid of modulation at a power level of not less than 25 watts of R.F. energy.

c. The Stoddart Field Intensity meter, NM-20-A or equivalent, shall have the vertical antenna erected one (1) foot. The dummy antenna of the transmitter and the vertical antenna of the meter shall be spaced three (3) feet apart.

d. Key the transmitter, and determine the level of the fundamental signal by means of the Field Intensity Meter.

e. Without disturbing any settings or adjustments, other than the calibrated attenuator of the meter, set the dial of the meter to read the second, third, and fourth harmonics of the fundamental carrier.

Requirement:

a. The second harmonic shall be 25 decibels, or more, below the relative level of the fundamental.

b. The third harmonic shall be 30 decibels, or more, below the relative level of the fundamental.

c. The fourth, and higher order harmonics, shall be 80 decibels, or more, below the relative level of the fundamental.

3.3.5.3. Spurious Radiation

Method of Test

a. Identical to that required by Section 3.3.5.2. above, except that the spectrum shall be examined over the frequency range of from 15 kcs to 220 mcs.

Requirement:

a. No spurious radiation shall be generated other than the harmonics enumerated in Section 3.3.5.2. above over the frequency range of from 15 kilocycles to 220 megacycles. The generation of any R.F. power with the crystal removed shall not be permitted.

3.4. AK-3 Keyer

3.4.1. Keyer Speed Regulation, if Mechanically Driven

Method of Test

a. The spring motor shall be fully wound, and a cartridge, or reel, of keying medium inserted in the device.

b. The drive capstan, or an associated idler, which is directly driven by the capstan, shall be illuminated by an accurately calibrated Strobotach.

c. Activate the keyer and observe the starting and terminal speed at the time period equal to the transmission of 125 groups of message text.

Requirement:

a. The speed of an individual unit may vary by not more than +0 or -10 percent.

b. The speed variation between units may vary by not more than +5 or -5 percent.

3.4.2. Keyer Speed Regulation, if Electric Motor Driven

Method of Test

a. The keyer shall be loaded with a cartridge, or reel, of keying medium.

b. The drive capstan, or an associated idler which is directly driven by the capstan, shall be illuminated by an accurately calibrated Strobotach.

c. Activate the keyer and observe the starting and terminal speed at the time period equal to the transmission of 125 groups of message text.

d. Conduct the test at ten (10), twelve (12), and fourteen (14) volts input, DC, to the keyer motor.

Requirement:

a. The speed of an individual unit may vary by not more than plus 5 and minus 5 percent.

b. The speed variation between units may vary by not more than plus 5 and minus 5 percent.

3.4.3. Electrical Noise

3.4.3.1. Radiated Interference

Method of Test

a. The keyer shall be set for operation under normal load at twelve (12) volts.

b. The Stoddart Field Intensity meter, Type NM-20-A or equivalent, shall have the vertical antenna erected one (1) foot.

c. The antenna of the Field Intensity meter and the keyer shall be spaced one (1) foot apart.

d. Energize the keyer.

Requirement:

a. The radiated noise shall not exceed .1 microvolts/meter at any frequency in the range of from 15 kilocycles to 220 megacycles.

3.4.3.2. Conducted Noise

Method of Test

a. The keyer shall be set for operation under normal load at twelve (12) volts.

b. A Stoddart Line Probe shall be inserted in the electric feed lines to the motor.

c. Energize the keyer.

Requirement:

a. The maximum allowable conducted noise shall not exceed 2 microvolts at any frequency in the range of from 15 kilocycles to 220 megacycles.

3.4.4. Audible Noise

Method of Test

a. This test is to be conducted in a room which generally conforms to the NARTB specification for a soundproof room.

b. The keyer shall be set for operation under normal load at twelve (12) volts.

c. A General Radio Sound Level Meter Type 759-B or equivalent shall be placed six (6) feet from the keyer and set for Weighting Factor "B."

d. Energize the keyer.

Requirement:

The audible noise generated shall be not more than 15 decibels above ambient.

3.5. AP/BA-3 Power Supply

3.5.1. Electrical Noise

Method of Test

a. The power supply will be loaded into a non-inductive resistance load which will provide the identical loading of the complete system in normal operation.

b. The power leads of the AP/BA-3 supply shall be connected to a constant source of **twelve volts.**

c. Conduct the balance of the test in accordance with Section 3.4.3.1. (b) and (c), and Section 3.4.3.2. (b) above.

Requirement:

a. Radiated Interference shall not exceed .1 microvolts/meter at any frequency in the range of from 15 kilocycles to 220 megacycles.

b. Conducted noise shall not exceed 2 microvolts at any frequency in the range of from 15 kilocycles to 220 megacycles.

3.5.2. Audible Noise

Method of Test

The test conditions of Section 3.4.4. shall apply, except as modified.

Requirement:

The audible noise generated shall not exceed 10 decibels above ambient.